On Detector Electronics

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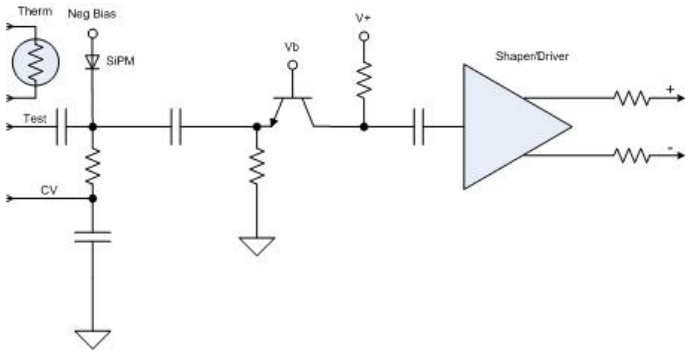
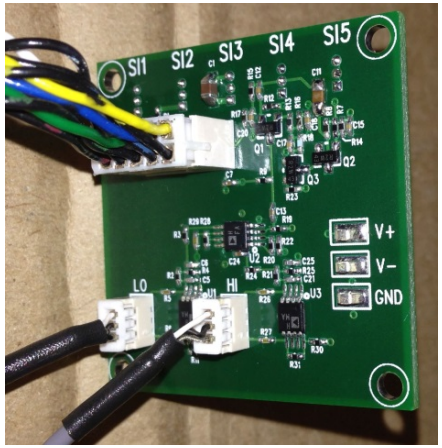
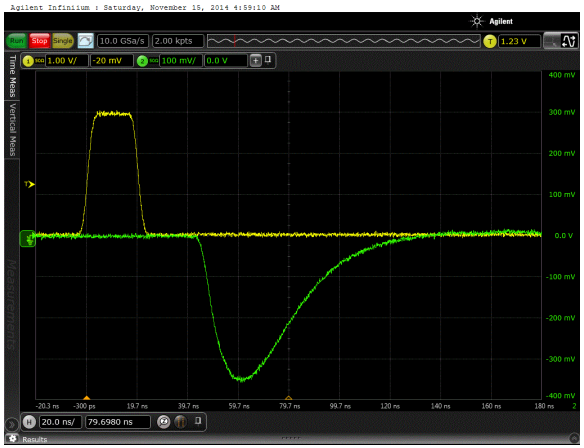
- Preamplifier
- Slow Controls
- System Layout and Interconnect
- Power Supply, PC Board, Cable and Crate Totals
- Testing Plan

sPHENIX Preamp





HCal Prototype Preamp

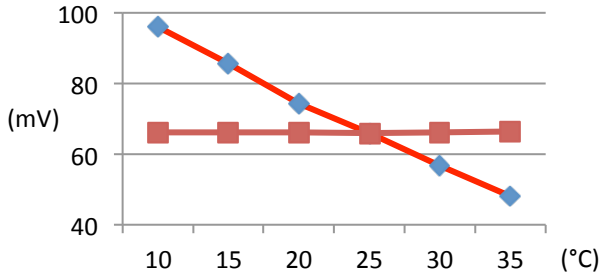


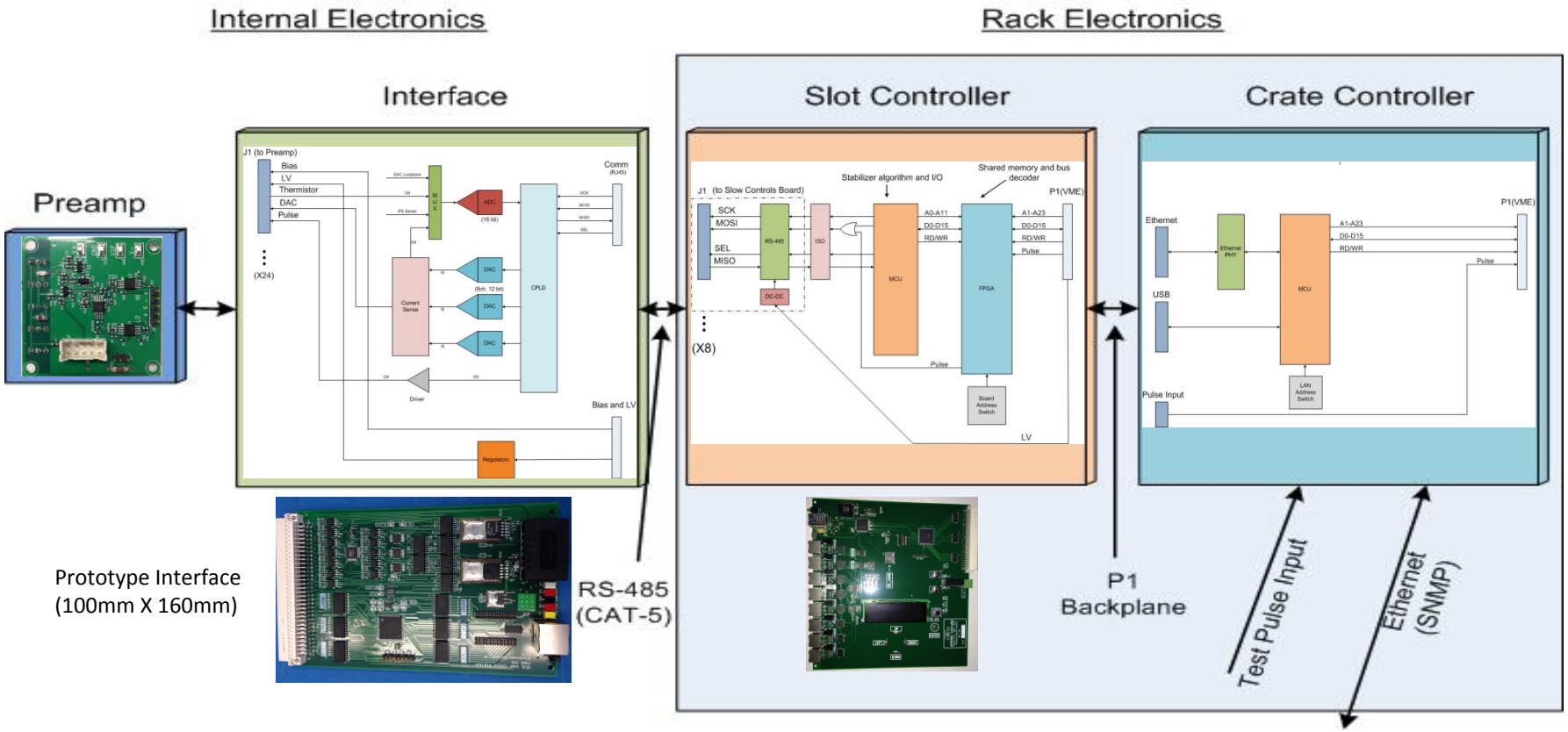
Test Pulse Output

- Local thermistor for temp monitoring.
- Control voltage input for trimming bias +/- 2.5V.
- Charge injector for signal test.
- Differential multiple-feedback filter/driver with 30nS peaking time for 60MHz ADC sampling.
- P_{tot} approximately 300mW.
- SNR approximately one microcell (1 MIP ~ 35 microcells).

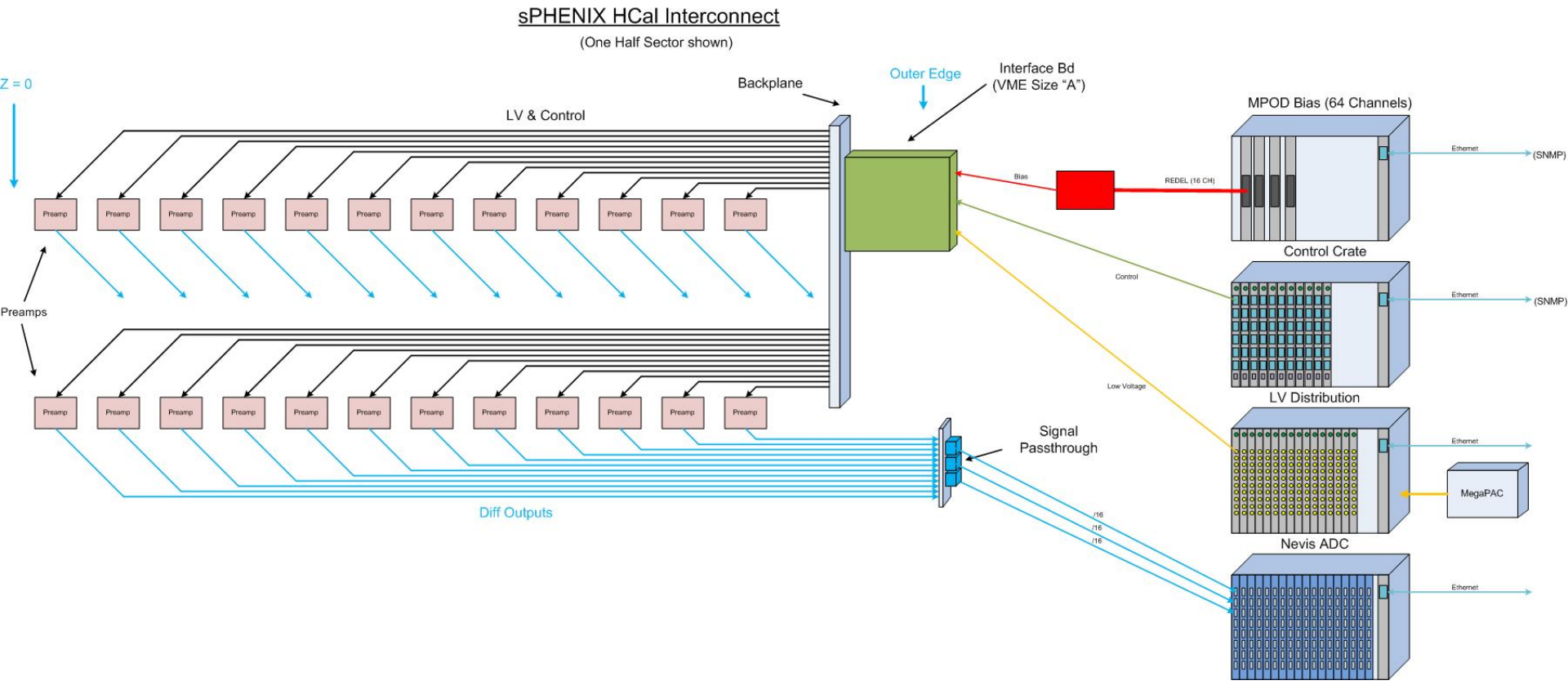
Slow Controls

- Compensate SiPM V_{br} temperature coefficient.
- Gain trimming.
- Leakage current monitoring and compensation.
- Charge and LED pulse generation.





System Layout and Interconnect



LV Supplies

EmCal Preamps

- Each Interface (64 chan) requires +6V, -6V at approx 2.1A.
- There are 96 Interfaces or 201.6A per quad which requires 8 MegaPAC modules (+6V -6V). For increased overhead capacity we will use 10 modules in a single MegaPAC for each quad, 4 MegaPACs total.

EmCal ADC Crates

- 2 racks with 3 crates and one MegaPAC in each rack per quad, 8 MegaPACs total.

HCal Preamp/Interface LV

- 128 total Interface Boards, ~ +/-1A each. One MegaPAC (4 MegaPACs total) and one Distribution crate or MPOD per quad.

HCal Control Crate LV

- One crate with 10 2/3 Slot controllers and Crate Controller per quad. 5V @ ~5A, 50W DIN Rail supply.

HCal ADC Crates

- One crate + MegaPAC per quad, 4 MegaPACs total.

- Total number of MegaPACs:
- 8 on Top (bridge), 8 on bottom.
- Total MegaPACs for sPHENIX is then 16.

Bias Supplies

- EmCal
- MPOD:
- 96 Interfaces per quad requires 2 MPOD crates, each with a total of six 8 channel ISEG output modules.

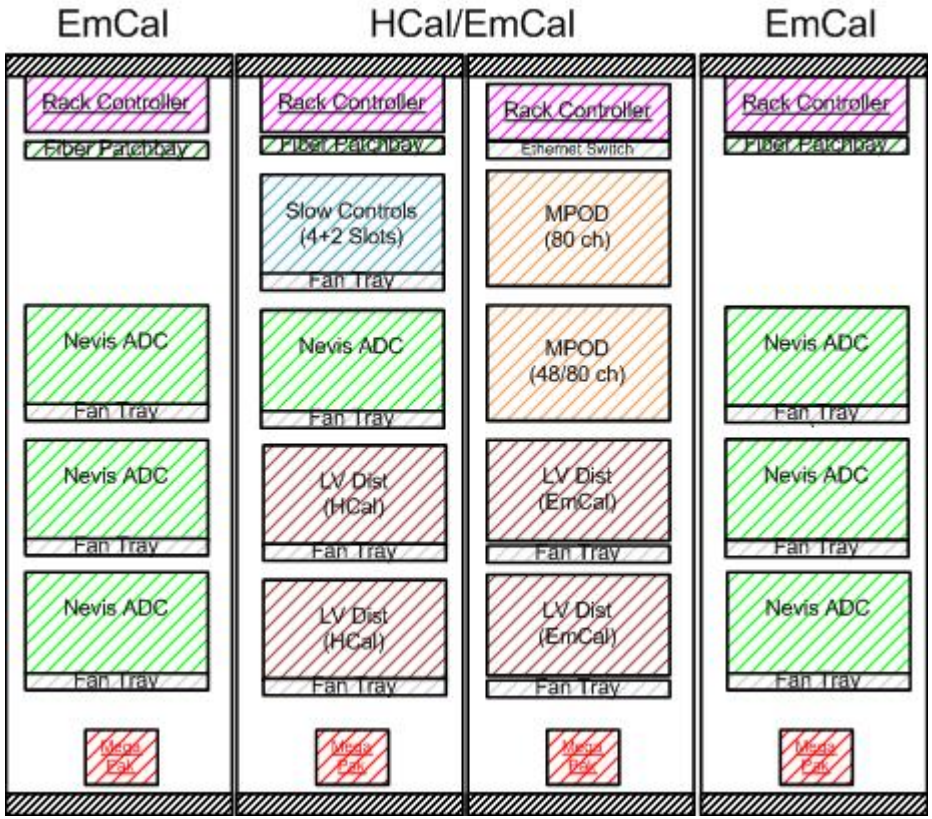
- HCAL
- MPOD:
- Using one bias channel input to every 24 channel Interface requires 3072/24 = 128 bias channels which is two MPOD crates.

System Circuit Board/Crate Totals

- EmCal
  - 256 channels in Φ by 96 in Z = 24576 total.
  - Divided into 32 Sectors in Φ which are divided further into 64 North and South Half-Sectors for cabling purposes. Each Half-Sector has 384 channels.
  - 1536 2X8 channel Preamp Boards.
  - 384 Interface Boards.
  - 64 Slot Controllers divided into 4 crates of 16 each.
  - 4 Crates with 1 Controller each.

- HCal
  - 64 channels in Φ by 48 in Z = 3072 channels total.
  - Divided into 32 Sectors in Φ which are divided further into 64 North and South Half-Sectors for cabling purposes. Each Half-Sector has 48 channels.
  - 3072 Preamps.
  - 128 Interface Boards, two each per half sector.
  - 16 Slot Controllers divided into 2 crates of 8 each for cabling purposes.
  - 2 Crates with 1 Controller each.

Electronics Racks
(One Quad)



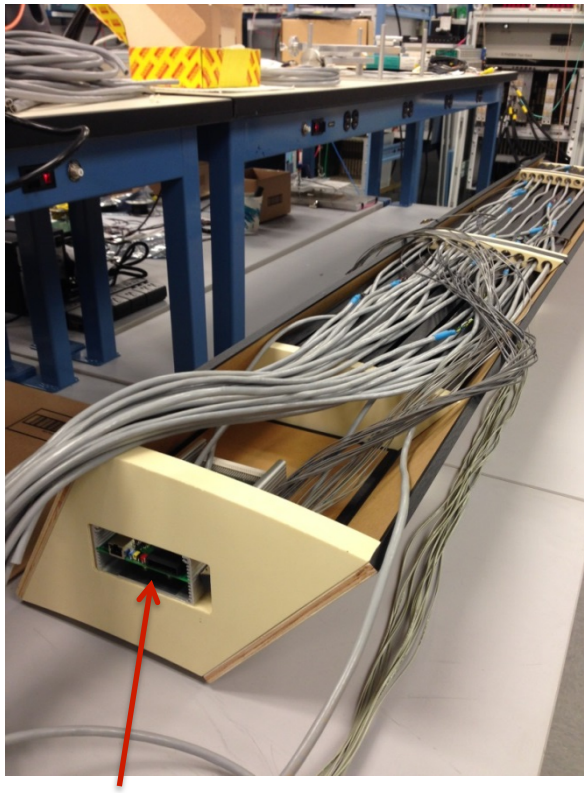
Cable Plant

- **EmCal For one Quad**
- One Quad refers to the top or bottom half of the North or South end of the magnet. The length of arc to route cables at a radius of one meter is 628cm/4 = 157 cm or 62”.
- 96 LV/Bias Cables -> 0.25” (0.635 cm) diameter.
- 96 Comm Cables-> 0.25” (0.635 cm) diameter.
- 384 Signal Cables (Meritec) -> 0.5” (1.27 cm) diameter.

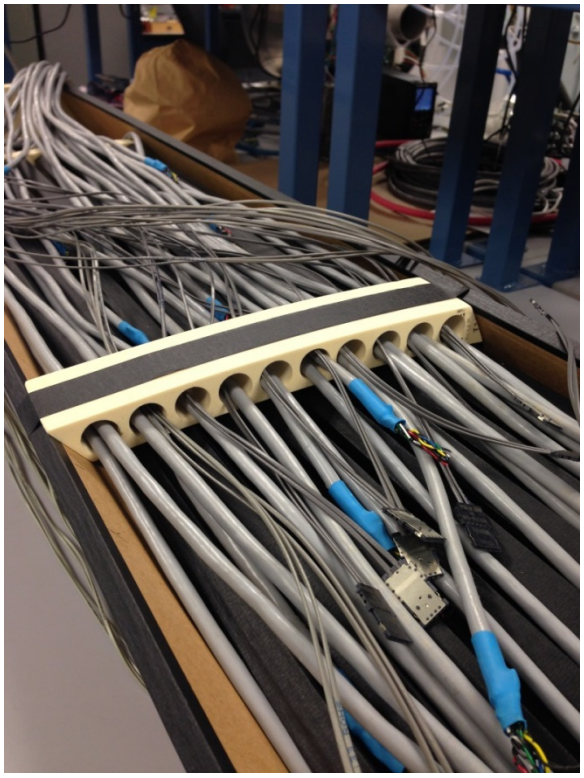
- **HCal for one quad**
- If HCal has 3072 channels so one quad 3072/4 = 768 channels.
- 32 LV/Bias Cables -> 0.25” (0.635 cm) diameter.
- 32 Comm Cables -> -> 0.25” (0.635 cm) diameter.
- 64 Signal Cables (Meritec) -> 0.50” (1.27 cm) diameter.

Inner HCal Wooden Mockup

Mockup used as an aid for physical cable sizing.



HCal Interface



Mockups of Outer HCal and EmCal are to be built in the coming months.

Power Dissipation

Estimated Preamp Load Power: ~300mW/chan.

Estimated Control Interface Load Power: ~5mW/chan.

Inside Magnet

EmCal Preamp: 24576 X 300mW = 7373W.
EmCal Control: 24576 X 5mW = 123W.
EmCal Regulator: 375W
HCal Preamp: 1536 X 300mW = 460W.
HCal Control: 1536 X 5mW = 7.7W.
HCal Regulator: 47W
Total: ~ 8.4kW

Outside

HCal Total: ~ 515W.

Testing Plan

- Resources have been allocated in WBS for prototype, pre-production and production electronics testing.
- Prototype electronics will be bench tested in Physics.
- Pre-production electronics will undergo full chain test.
- Electronics will be initially qualified and burned-in once electronics are mounted on detector.
- Details of the test plan will depend on the final design and will be worked out as a better understanding of the global production schedule is developed.

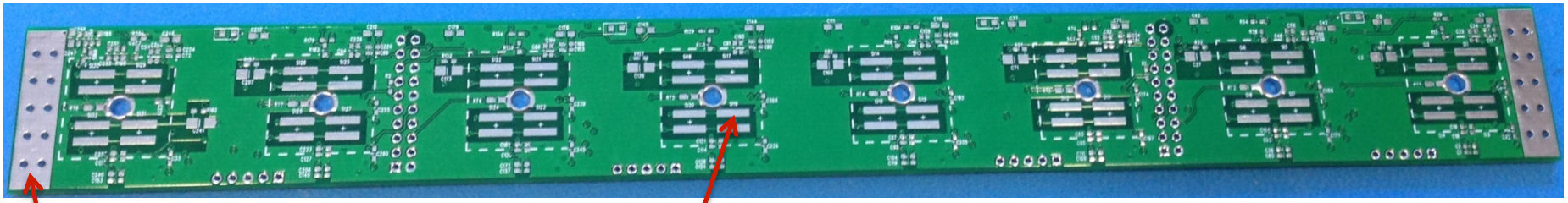
Extra Slides

EmCal Preamp

1 X 8 Test Beam Preamp

(Top)

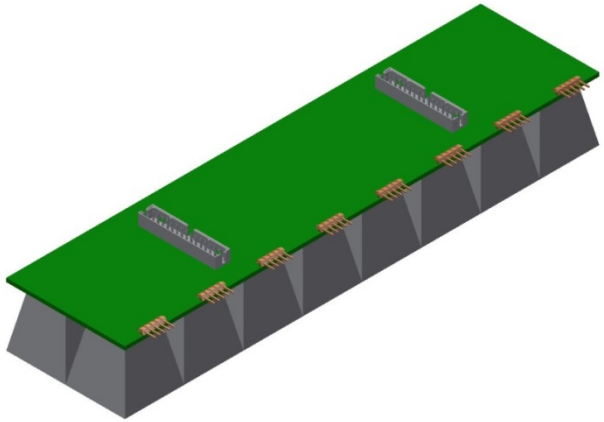
(Bottom)



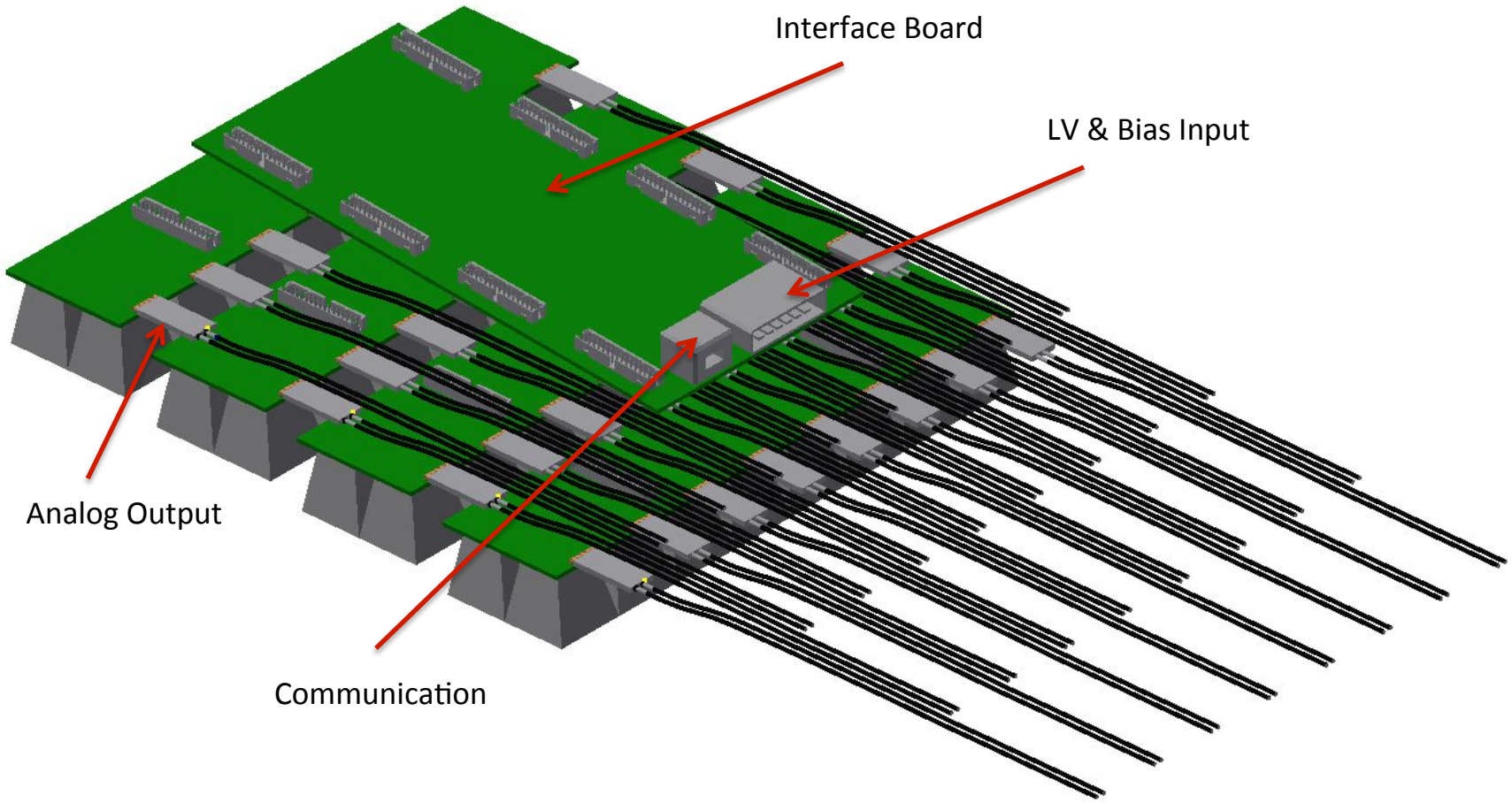
SiPM array mounted on bottom

Cooling pad connects to all copper planes

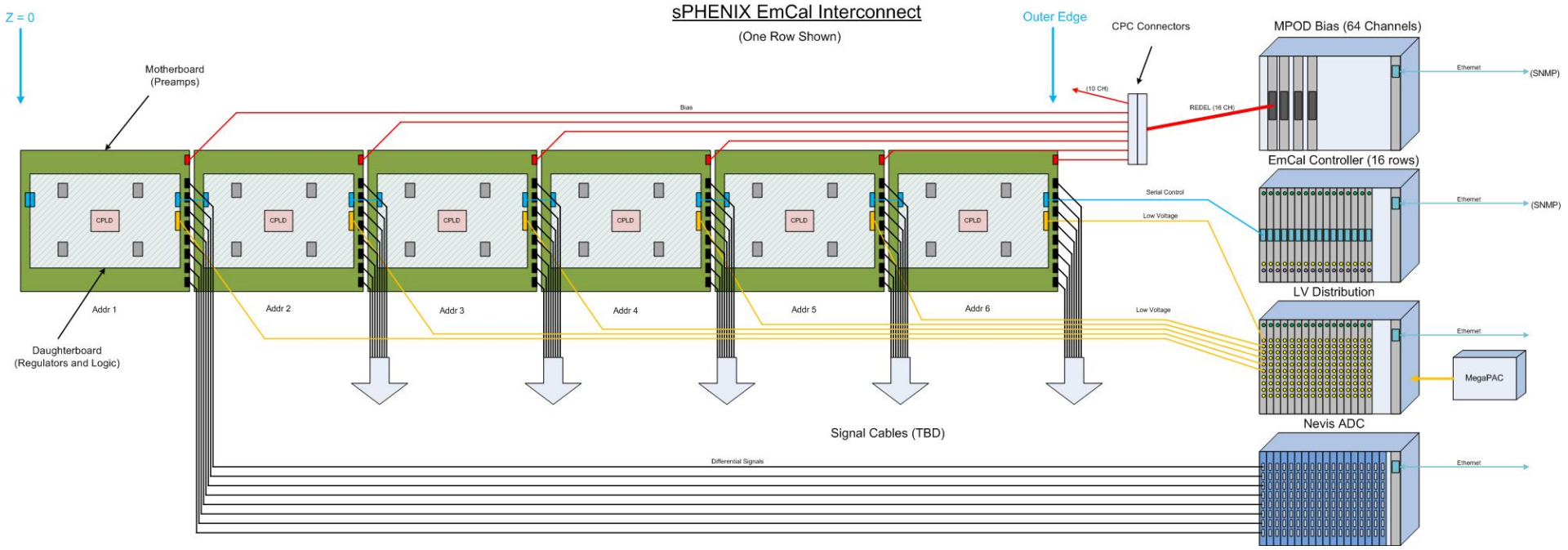
2 X 8 Production Preamp Concept



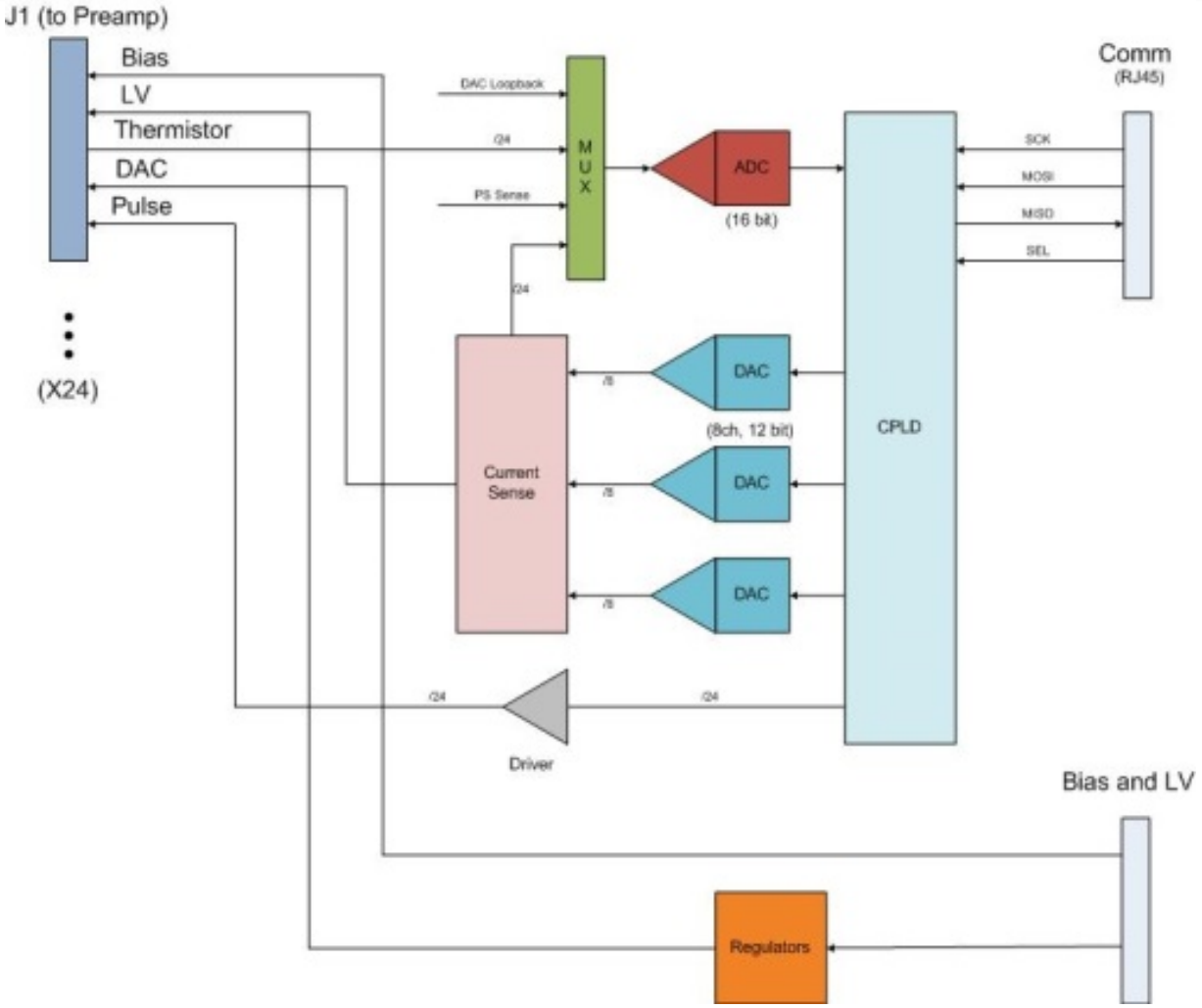
EmCal Preamps with Interface



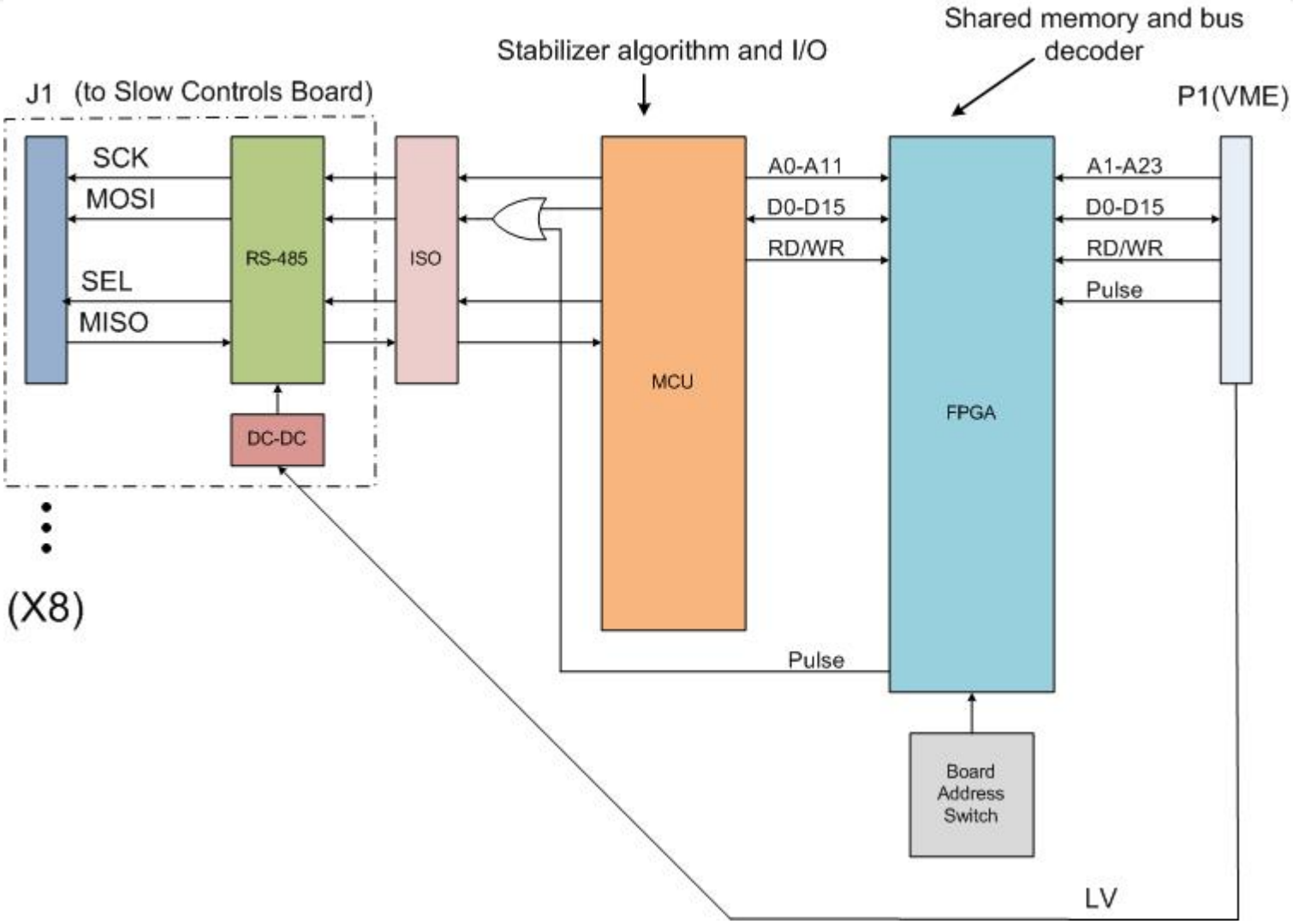
EmCal Interconnect



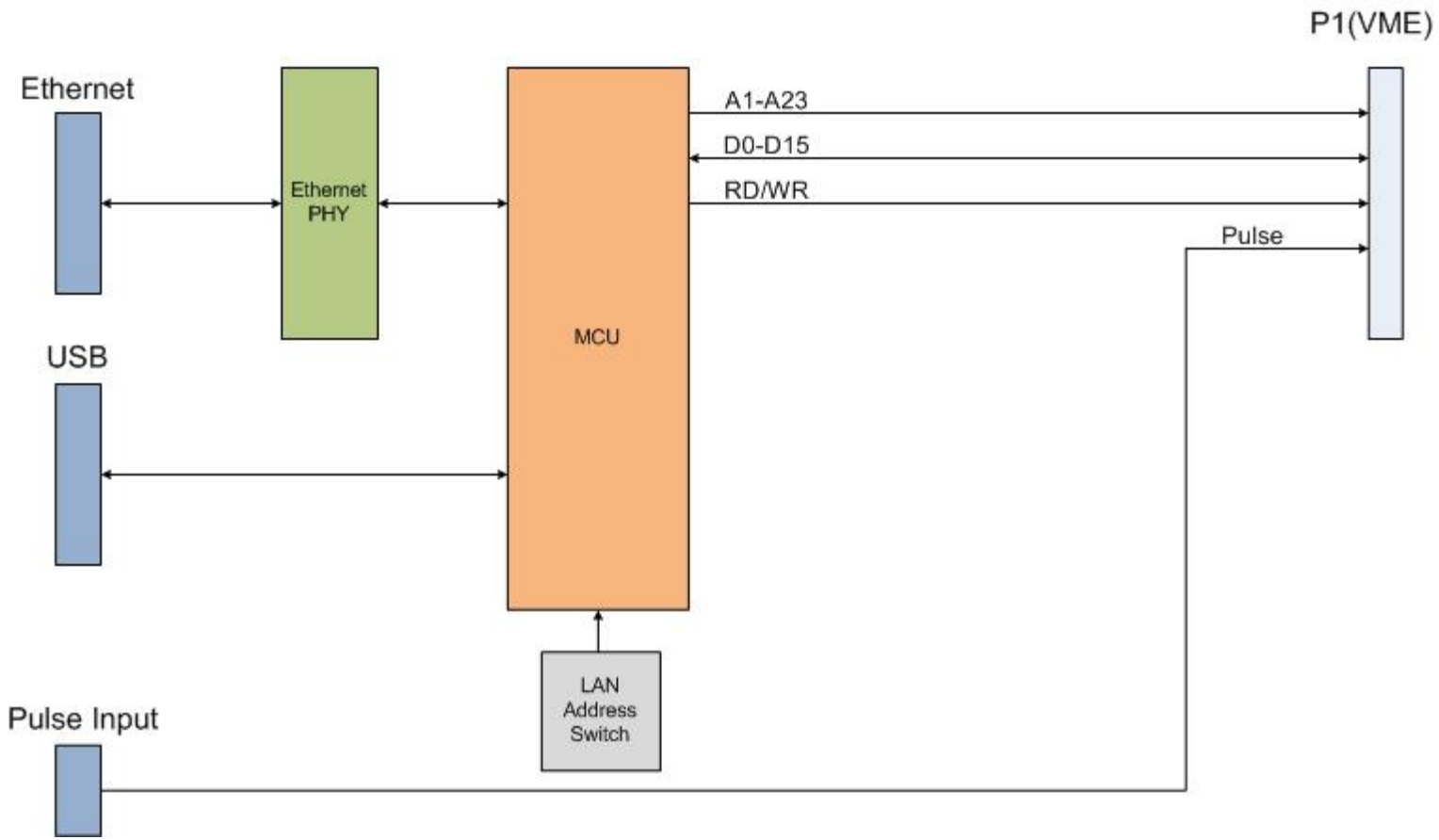
Control Interface



Slot Controller



Crate Controller



Grounding Plan